(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 385 255
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 90103354.8

(22) Date of filing: 21.02.90

(51) Int. Cl.5: B66B 7/06, B66B 11/04

(30) Priority: 28.02.89 JP 49719/89

(43) Date of publication of application:
05.09.90 Bulletin 90/36

(84) Designated Contracting States:
CH DE ES FR GB IT LI

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(54) Rope weight compensating device for linear motor driven type elevator.

(57) A rope weight compensating device for a linear motor driven type elevator having an elevator car and a counterweight which are suspended on opposite sides through a rope guided by a sheave, characterized in that the rope weight is compensated by using a cable weight, said cable supplying a driving power to a movable member which functions as a primary side of the linear motor.

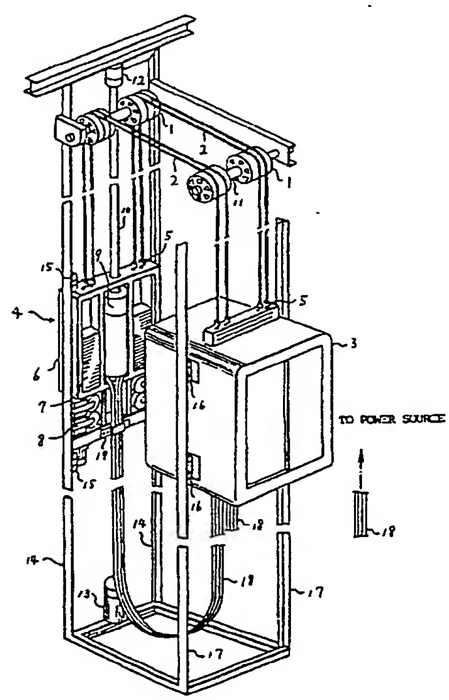

FIG. 1

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ROPE WEIGHT COMPENSATING DEVICE FOR LINEAR MOTOR DRIVEN TYPE ELEVATOR

The present invention relates to a rope weight compensating device for a linear motor, and particularly to a rope weight compensating device which performs this compensation by using a weight of a cable supplying the electric power necessary for driving the linear motor.

In a so-called traction type elevator system wherein ropes wound around sheaves are lifted by the sheaves which are rotated by a rotary motor so as to ascend and descend an elevator car and a counterweight which are respectively suspended from both ends of each rope, a balance chain is used as a rope weight compensating means to prevent tracking which is otherwise generated when unbalance of the weight between on the sides of the elevator car and the counterweight exists.

On the other hand, in a linear motor driven type elevator system which has been recently developed, since the counterweight or the elevator car itself is directly driven linearly by the linear motor and the sheave around which the ropes are wound or guided is an idler to be driven by the ropes, the problem due to the occurrence of the tracking as in the traction type elevator does not substantially exist other than when the elevator is stopped.

However, when no means is provided for compensating the rope weight, for example, when the counterweight provided with the linear motor movable element is positioned at its lowermost level and the elevator car is positioned at its uppermost level with a loading weight being zero, the required output of the linear motor inevitably becomes high resulting in increased power consumption and the need to reinforce the wiring and to increase the braking force of the braking unit which is operated when the elevator car is stopped at predetermind positions and also when emergency occurs such as power failure.

Accordingly, it is better to provide means for compensating the rope weight even for the linear motor driven type elevator system. However, in the linear motor driven type elevator system, since the cable which is used for supplying a large amount of current to the linear motor becomes considerably heavy per unit length, it is not preferable to use the balance chain in addition to the heavy cable in view of assembly facility.

An object of the present invention is to provide a rope weight compensating device which can perform the compensation of the rope weight without using the balance chain.

In order to accomplish the above mentioned object, a rope weight compensating device according to the present invention is constituted such that in a linear motor driven type elevator having an elevator car and a counterweight which are suspended on opposite sides through a rope guided by a sheave, the rope weight is compensated by using a cable weight, said cable supplying driving power to a movable member which functions as a primary side of the linear motor.

In the present invention structured as above, the rope weight compensation is done through the cable weight.

A preferred embodiment of the present invention will be explained with reference to the attached drawings.

In Fig. 1, an elevator car 3 and a counterweight 4 are suspended through hooks 5 at opposite ends of each rope 2 guided by sheaves 1. The counterweight 4 is constituted by a frame 6, weight 7, a braking unit 8 and a movable member 9 which functions as a primary side of a toroidal type linear motor. At the center of the movable member 9, a fixed column 10 passes through vertically with a predetermind clearance to the movable member 9. The fixed column 10 functions as a secondary side stationary member of the linear motor. The sheaves 1 are rotatably mounted onto shafts 11 respectively which are in turn fixed to the building side. The fixed column 10 is fixed at its upper and lower ends to the building side through support members 12 and 13.

A braking unit 8 is electromagnetically operated and grasps frames 14, 14 fixed to the building side every time the elevator car, i.e. the linear motor is stopped in a normal operation, and also in an emergency such as power failure. Rollers 15,15,15,15 arranged at the upper and lower end portions of the counterweight 4 are rotatably engaged with the frames 14,14 so as to guide the counterweight smoothly. On the other hand, rollers 16,16,16,16 arranged at both sides of the elevator car 3 are also rotatably engaged with frames 17, 17 fixed to the building side so as to guide the elevator car 3 smoothly.

Three cables 18 are suspended from the counterweight 4 through a fixing member 19 and one end of each cable 18 is connected to the movable member 9 of the linear motor. The cables 18 are in turn connected to the three-phase AC supply at their other ends via the lower end wall of the elevator car 3, i.e. a first part of the length of cables 18 is between the counterweight 4 and the car 3, and the remaining second part of the length of cables 18 is between the car 3 and the AC supply. Accordingly, the linear motor movable member 9 is supplied with the three-phase AC

through the cables 18. The cables 18 can be attached to the lower end wall of the elevator car 3 by known fixing members such as the fixing member 19 or the like.

In Fig. 2, when the linear motor movable member 9 starts to travel up and down by means of the electromagnetic force generated between the movable member 9 and the fixed column 10, the counterweight as a whole starts to travel up and down and the elevator car 3 in turn travels up and down through the ropes 2. Assuming that the entirety of the counterweight and the entirety of the elevator car are even in their weight and that the counterweight 4 is positioned at its lowermost level and the elevator car 3 is positioned at its uppermost level, when no means for compensating the rope weight is provided, a rope weight corresponding to L1-L2 is applied to the counterweight side, which requires the corresponding output of the linear motor for going up. On the contrary, when the cables 18 are provided as shown in Fig. 2, the rope weight of L1-L2 is compensated by a cable weight of L4-L3 so that the output required to the linear motor can be set lower.

L5 is the hanging length of the second part of cables 18, hanging from the car 3.

It is to be noted that a cable weight corresponding to L5 (a curved portion makes an actual length longer than L5) is also applied to the elevator car side, which makes the weight balance between the elevator car side and the counterweight side out of order. In order to compensate this, a weight corresponding to the cable weight of L5 when the elevator car is positioned at a half of its entire travel stroke, is added to the counterweight 4 so as to minimize the weight unbalance.

In this embodiment, each cable 18 is constituted by some tens of mutually insulated leads and weighs 1.15kg/m. On the other hand, each rope weighs 0.55kg/m so that the cables 18 functions enough as the rope weight compensating means.

It is to be noted that signal lines connecting the linear motor movable member 9 and the elevator car 3 to the known system control unit as well as leads supplying the power to the elevator car 3 for lighting are preferably arranged along the cables 18. Further, though the cables 18 are arranged between the counterweight and the power supply via the elevator car in this embodiment, it is also possible to arrange the cables 18 between the elevator car and the power supply via the counterweight. In this case, however, the cables connecting the power supply and the counterweight and the cables connecting the counterweight and the elevator car should be separate members and it is preferable to use the cables between the counterweight and the elevator car solely as the rope weight compensating means. Still further, though the linear motor is arranged on the counterweight side in this embodiment, it may be alternatively provided on the elevator car side.

In the present invention, since the rope weight compensation is performed by the cable weight, no separate balance chain is necessary for accomplishing such compensation.

Fig. 1 is a perspective view showing the linear motor driven type elevator system according to a preferred embodiment of the present invention, and Fig. 2 is a diagram showing the operation of the elevator system of Fig. 1.

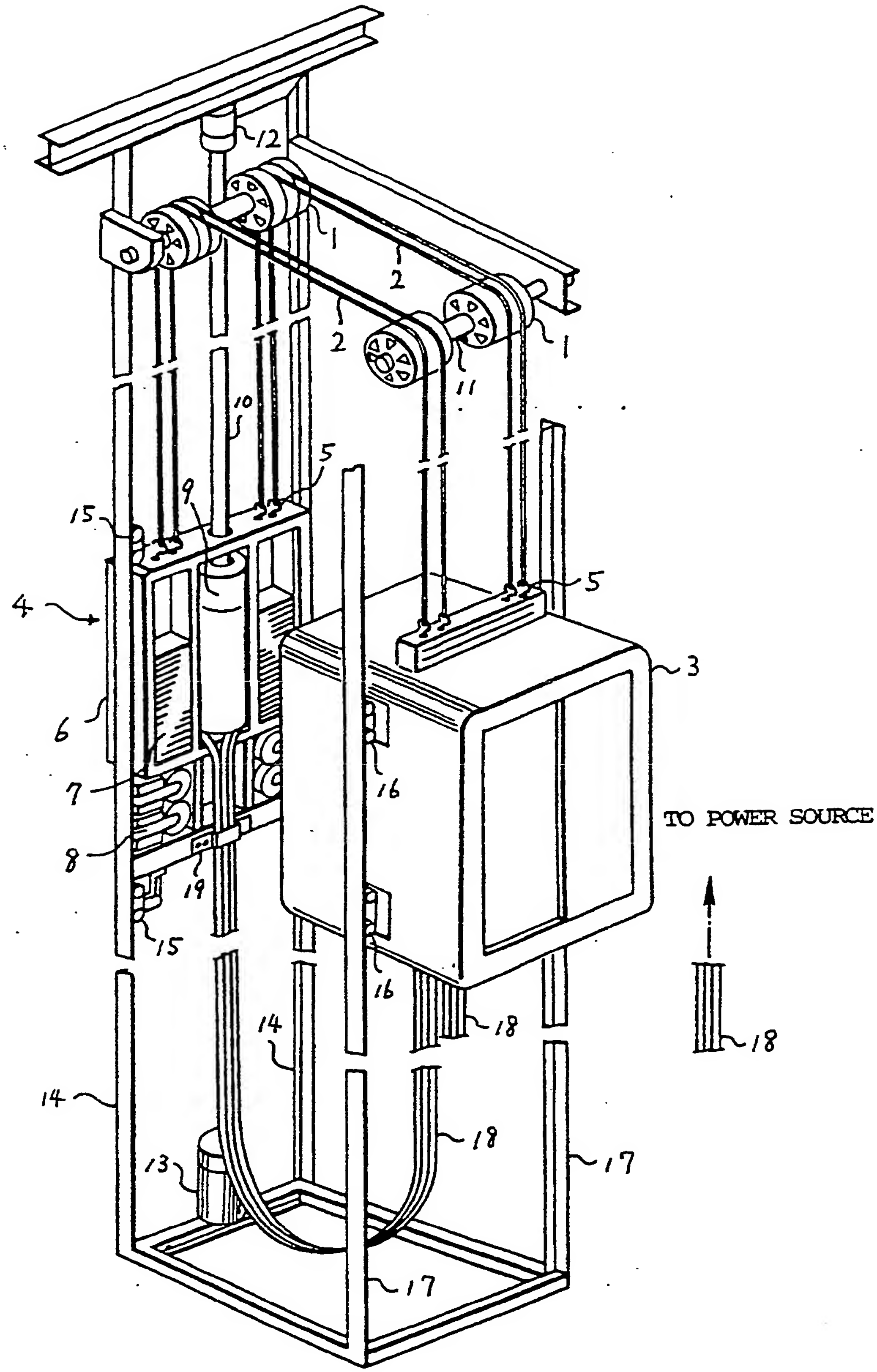
Claims

1. A rope weight compensating device for a linear motor driven type elevator having an elevator car and a counterweight which are suspended on opposite sides through a rope guided by a sheave, characterized in that the rope weight is compensated by using a cable weight, said cable supplying a driving power to a movable member which functions as a primary side of the linear motor.

2. The rope weight compensating device as set forth in claim 1, wherein said movable member is fixed to the counterweight and said cable is connected at its one end to the movable member and at its other end to a power source via said elevator car.

3. The rope weight compensating device as set forth in claim 2, wherein said cable is fixed to a lower end wall of the elevator car.

4. The rope weight compensating device as set forth in claim 2 or 3, wherein an additional weight is added to the counterweight, said additional weight corresponding to a weight to be applied to said elevator car due to the cable between the elevator car and the power source when the elevator car is positioned at a half of its entire travel stroke.


12
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TO POWER SOURCE
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FIG. 1

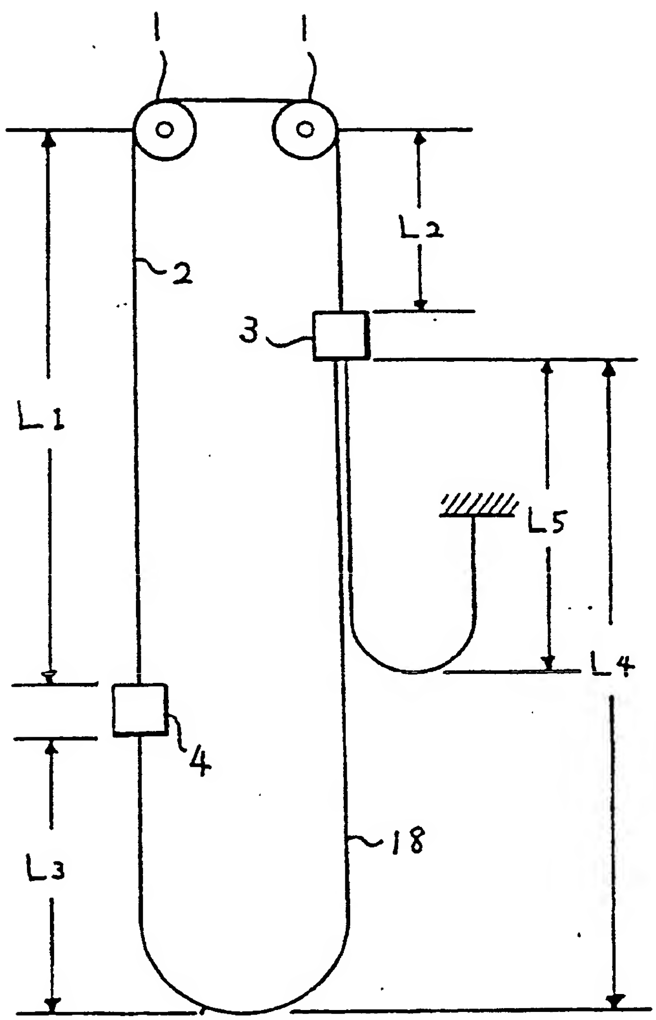

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number

EP 90 10 3354

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0048847 (OTIS ELEVATOR COMPANY) * page 3, lines 25 - 36; figures 1, 2 * ---	1-3	B66B7/06 B66B11/04
A	DE-A-3422374 (HEIDENREICH) * page 6, lines 19 - 23 * * page 8, lines 7 - 9; figure 1 * ---	1-3	
A	EP-A-0100583 (SIECOR CORPORATION) * page 5, line 14 - page 6, line 16; figure 1 * ---	1-3	
A	US-A-3896905 (SOLYMOS) * column 4, line 53 - column 5, line 45; figures 2-4 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06 JUNE 1990	CLEARY F.M.

CATEGORY OF CITED DOCUMENTS

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